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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Paper No. 18

Application Number: 09/827,454
Filing Date: April 06, 2001
Appellant(s): RUGGIERO, ANTHONY J.

Michael C. Staggs
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 24 February 2004.

(1) ***Real Party in Interest***

A statement identifying the real party in interest is contained in the brief.

(2) ***Related Appeals and Interferences***

The brief does not contain a statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief. Therefore, it is presumed that there are none. The Board, however, may exercise its discretion to require an explicit statement as to the existence of any related appeals and interferences.

(3) ***Status of Claims***

The statement of the status of the claims contained in the brief is correct.

(4) ***Status of Amendments After Final***

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

No amendment after final has been filed.

(5) ***Summary of Invention***

The summary of invention contained in the brief is correct.

(6) ***Issues***

The appellant's statement of the issues in the brief is substantially correct. The changes are as follows:

Section "C" in appellant's statement of the issues in the brief should not include Pepper et al. (US 5,038,359 A). Section "C" should be "Whether claims 18, 19, and 21 would have been obvious under 35 U.S.C. 103(a) over Akkapeddi (US 4,949,056 A) in view of Vasil'ev et al.

("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997)."

(7) Grouping of Claims

Appellant's statement of the grouping of claims contained in the brief is silent regarding claims 18, 19, and 21. The rejection of claims 18, 19, and 21 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

US 4,949,056 A	AKKAPEDDI	08-1990
US 5,317,442 A	SHARP et al.	05-1994
US 5,038,359 A	PEPPER et al.	08-1991
US 5,519,723 A	MACDONALD	05-1996
US 5,675,436 A	DAMEN et al.	10-1997
US 5,920,588 A	WATANABE	07-1999

Vasil'ev, Peter P. and Ian H. White. "Phase-conjugation broad area twin-contact semiconductor laser." Applied Physics Letters, vol. 71, no. 1, 07 July 1997, pp. 40-42.

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-7, 9-14, 16, 17, 40, 41, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi (US 4,949,056 A) in view of Vasil'ev et al. ("Phase-

conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997) and Pepper et al. (US 5,038,359 A).

Regarding claim 1, Akkapeddi discloses a system (Figure 1) comprising:

a transceiver (satellite 10) constructed to transmit an interrogating beam; and

a communication station capable of receiving the interrogating beam.

Although a communication station is not explicitly labeled in Figure 1, the figure clearly shows elements receiving and processing the beam transmitted from transceiver 10 that may be collectively regarded as a communication station in the art.

Akkapeddi further discloses that the communication station includes a phase conjugator 16 (shown in detail in Figure 2) but does not specifically disclose that the communication station includes a plurality of broad area intra-cavity phase conjugators arranged in an array.

Akkapeddi discloses that the phase conjugator 16 is a photorefractive crystal-type phase conjugation element that requires a pump beam from laser 20 (column 2, lines 34-44). However, Vasil'ev et al. teach a broad area, intra-cavity phase conjugator that does not require an external pump beam source (Figures 1a and 1b; see also page 40, 1st paragraph in the left column and page 42, 1st complete paragraph in the left column) which may be used in a communication system to produce a phase conjugate beam such as in the communication system disclosed by Akkapeddi.

It would have been obvious to use the broad area, intra-cavity phase conjugator taught by Vasil'ev et al. instead of the type of phase conjugator in the system disclosed by Akkapeddi as a way to provide the phase conjugate light beam already disclosed but without requiring a separate source of pump light. One in the art would have been further motivated to incorporate the

teachings of Vasil'ev et al. in the system disclosed by Akkapeddi because Vasil'ev et al. specifically teach that broad area, intra-cavity phase conjugators have several additional advantages over photorefractive crystal phase conjugators, including increased speed and portability, and the ability to be more easily integrated into existing systems (page 40, 1st paragraph in the left column).

Further regarding claim 1, Akkapeddi in view of Vasil'ev et al. do not specifically suggest phase conjugators arranged in an array. However, Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) also teach phase conjugator elements (i.e., elements 174, 176, and 178 in Figure 10) and also further suggests that phase conjugators may be arranged in an array.

It would have been obvious to a person of ordinary skill in the art to further arrange the phase conjugators in an array as taught by Pepper et al. in the system suggested by Akkapeddi in view of Vasil'ev et al. to provide a broader area for producing phase conjugation. In other words, one in the art would have been particularly motivated to incorporate the teachings of Pepper et al. in the system suggested by Akkapeddi in view of Vasil'ev et al. so that more than one beam may be received by the phase conjugator system at more than one specific location (especially in a large aperture system as specifically suggested by Pepper et al.; column 10, lines 60-62 and column 11, lines 11-13). Again, Akkapeddi already generally discloses a communication station which receives an interrogating beam and which includes a phase conjugator.

Examiner notes that claim 1 does not further recite any specific interaction or connection between the recited interrogating beam and the recited phase conjugator elements.

Regarding claim 2, Akkapeddi discloses that the communication station is capable of transmitting an encoded phase conjugate beam to the transceiver from the phase conjugator (using encoder 26). The phase conjugators taught by Vasil'ev et al. and Pepper et al., in the system suggested by the combination of the three references, would also be capable of transmitting an encoded phase conjugate beam from the system.

Regarding claim 3, Akkapeddi discloses that communication station is configured to respond to the interrogating beam by encoding data into a phase conjugate beam (using encoder 26) and the phase conjugator taught by Vasil'ev et al. pumps the encoded phase conjugate beam by intra-cavity nondegenerate four wave mixing (Abstract).

Regarding claims 4-5, Akkapeddi does not specifically disclose that the encoding of the phase conjugate beam is accomplished at rates exceeding approximately 1 kHz or in the range of approximately 1 GHz to approximately 10 GHz.. However, Vasil'ev et al. specifically teach a phase conjugator with a "subnanosecond response" (column 1, paragraph 1), which would be understood in the art as corresponding to a rate in the range of above 1 GHz. Also, Pepper et al. teach that a phase conjugate beam may be encoded at rates including 10 GHz (column 8, lines 32-50). It would have been obvious to a person of ordinary skill in the art to encode the phase conjugate beam as disclosed by Akkapeddi at rates suggested by Vasil'ev et al. or Pepper et al. as an engineering design choice of an efficient response rate for encoding the beam and to simply maximize the capabilities of the system.

Regarding claims 6, 7, and 9, again, Akkapeddi does not disclose a plurality of phase conjugators in an array. However, regarding claim 6, Pepper et al. (Figure 9, elements 148-150, for example, or Figure 10, elements 174, 176, and 178) that the plurality of phase conjugators

may be arranged in a substantially linear array. Regarding claim 7, Pepper et al. teach that the plurality of phase conjugators may be substantially spaced apart (Figures 9 and 10). Regarding claim 9, Pepper et al. teach that that plurality of phase conjugators may be any practical number, which would be understood in the art as including a number that is at least four (column 11, lines 14-17). Regarding claims 6, 7, and 9, it would have been obvious to a person of ordinary skill in the art to use an array of phase conjugators in a configuration as suggested by Pepper et al. in the system disclosed by Akkapeddi in view of Vasil'ev et al. as an engineering design choice of a way to arrange the phase conjugators so that more than one beam may be received by the phase conjugator system at more than one specific location.

Regarding claim 10, the broad area intra-cavity phase conjugator taught by Vasil'ev et al. (in the system suggested by Akkapeddi in view of Vasil'ev et al. and Pepper et al.) comprises an aperture sufficient to resolve a substantial portion of the spatial components of the input wavefront of the interrogating beam (Vasil'ev et al. teach that the phase conjugator element includes an aperture and outputs a phase conjugate signal corresponding to a received input probe beam; page 42, 1st complete paragraph in left column). Again, it would have been obvious to use the broad area, intra-cavity phase conjugator taught by Vasil'ev et al. instead of the type of phase conjugator in the system disclosed by Akkapeddi as a way to provide the phase conjugate light beam already disclosed but without requiring a separate source of pump light.

Regarding claim 11, Vasil'ev et al. do not specifically teach that the intra-cavity phase conjugator comprises an aperture sufficient to resolve greater than approximately 80% of the spatial components of the input wavefront of the interrogating beam, but they teach that it is able to generally resolve a substantial portion of the input wavefront of the interrogating beam. It

would have been obvious to a person of ordinary skill in the art to specifically ensure that the aperture is sufficient to resolve greater than 80% of the spatial components of the input wavefront of the interrogating beam in the system disclosed by Akkapeddi in view of Vasil'ev et al. and Pepper et al. simply in order to ensure that the input wavefront is properly resolved and a resulting phase conjugate signal is properly output.

Regarding claim 13, the intra-cavity phase conjugator taught by Vasil'ev et al. includes a top electrode with an aperture (page 40, 2nd complete paragraph in right column, teaches an upper metal contact, or a "top electrode," and also teaches the dimensions of an aperture). Again, it would have been obvious to use the intra-cavity phase conjugator taught by Vasil'ev et al. in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light.

Regarding claim 12, Akkapeddi discloses that the communication station does not have a movable part point and tracking system (column 1, lines 28-63; column 2, lines 15-44).

Regarding claim 14, Akkapeddi discloses that the interrogating beam may interact with pump beam operating in the phase conjugator at a substantially transverse angle (Figure 2).

Regarding claim 16, Akkapeddi discloses that the transceiver may be mounted on a satellite (Figure 1).

Regarding claim 17, Akkapeddi discloses that the communication station may be mounted on a ground station (column 2, lines 27-30).

Regarding claim 45, Pepper et al. does not specifically teach that the phase conjugators may be arranged in a two dimensional array, but they do teach that the phase conjugators may be one of a plurality of phase conjugators arranged in an array of phase conjugators (Figures 9 and

10). They do not specifically disclose that this array may be a two dimensional array, but it would have been obvious to a person of ordinary skill in the art to include a plurality of arrays of phase conjugators in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. as an engineering design choice of a way to arrange the phase conjugators especially since Pepper et al. teach that any number of phase conjugators may be included (column 11, lines 14-17). Again, one in the art would have been particularly motivated to incorporate the teachings of Pepper et al. in the system suggested by Akkapeddi in view of Vasil'ev et al. so that more than one beam may be received by the phase conjugator system at more than one specific location.

Regarding claim 40, Akkapeddi discloses a method (Figures 1 and 2) comprising:

transmitting an interrogating beam from a transceiver (satellite 10);

receiving the interrogating beam at a phase conjugator 16 through an aperture located in the top of the phase conjugator;

modulating data onto a phase conjugate beam (using encoder 26); and

transmitting the phase conjugate beam to the transceiver (via telescope 28).

Akkapeddi does not disclose an array of broad area intra-cavity phase conjugators. As similarly discussed above with regard to claim 1, Vasil'ev et al. teach a broad area intra-cavity conjugator for producing a phase conjugate beam as in the system disclosed by Akkapeddi. The phase conjugator taught by Vasil'ev et al. further includes a top electrode with an aperture (page 40, 2nd complete paragraph in right column). Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) teach another type of phase conjugator, but also further suggests that phase conjugators may be arranged in an array. As similarly discussed with regard to claim 1, it would have been obvious to use the broad area intra-cavity phase conjugator taught by Vasil'ev

et al. in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light, and to further arrange the phase conjugators in an array as taught by Pepper et al. so that more than one beam may be received by the phase conjugator system at more than one specific location.

Regarding claim 41, Akkapeddi disclose a method (Figures 1 and 2) comprising:

transmitting an interrogating beam from a transceiver (satellite 10);

receiving the interrogating beam at a phase conjugator 16 and resolving a substantial portion of the spatial components of the input wavefront of the interrogating beam;

modulating data onto a phase conjugate beam (using encoder 26); and

transmitting the phase conjugate beam to the transceiver (via telescope 28).

Again, Akkapeddi does not disclose an array of broad area intra-cavity phase conjugators. However, Vasil'ev et al. teach a broad area intra-cavity conjugator. Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) teach that a plurality of phase conjugators arranged in an array may be used in a system to produce a phase conjugate beam as in the method disclosed by Akkapeddi. It would have been obvious to use the broad area intra-cavity phase conjugator taught by Vasil'ev et al. in the system disclosed by Akkapeddi as a way to provide a phase conjugate light beam without requiring a separate source of pump light, and to further arrange the phase conjugators in an array as taught by Pepper et al. so that more than one beam may be received by the phase conjugator system at more than one specific location.

Claims 8 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi (US 4,949,056 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997) and Pepper et al. (US

5,038,359 A) as applied to claim 1 above, and further in view of Watanabe (US 5,920,588 A).

Regarding claim 8, the phase conjugator taught by Vasil'ev et al. is a laser diode type device but not specifically a single gain stripe device. However, Watanabe teaches an intra-cavity phase conjugator comprising a laser diode type device (Figure 2, element 1; column 16, lines 15-22) and further teaches that it may be specifically a single gain stripe device (column 16, lines 43-67; column 17, lines 1-3). It would have been obvious to a person of ordinary skill in the art to use a single gain stripe device as taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. as an engineering design choice of a way to implement the laser diode element for producing the phase conjugate beam already disclosed and suggested by Akkapeddi in view of Vasil'ev et al. and Pepper et al.. The claimed differences exist not as a result of an attempt by appellant to solve an unknown problem but merely amount to the selection of expedients known as design choices to one of ordinary skill in the art. Examiner notes appellant has not demonstrated that this particular recited feature ("single gain stripe devices") is critical; on the contrary, appellant's original specification on page 12-13, for example, discloses that a phase conjugator may comprise a choice of a VCSEL structure or a distributed feedback laser instead of "single gain stripe devices" as recited in claim 8.

Regarding claim 15, Akkapeddi does not teach that the interrogating beam may interact with pump beams operating in the plurality of phase conjugators in a substantially parallel manner, but Vasil'ev et al. teach that the interrogating beam may interact with the pump beams in a substantially parallel manner (Figure 1b), and Watanabe also teaches an intra-cavity phase conjugator wherein an interrogating beam may interact with pump beams in a substantially

parallel manner (Figure 2). It would have been obvious to a person of ordinary skill in the art to arrange the interrogating beam and pump beams as suggested by Vasil'ev et al. and Watanabe et al. in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. as an engineering design choice of an arrangement for the various elements. The claimed differences exist not as a result of an attempt by appellant to solve an unknown problem but merely amount to the selection of expedients known as design choices to one of ordinary skill in the art. Examiner notes appellant has not demonstrated that this particular recited feature ("a substantially parallel manner") is critical; on the contrary, appellant's claim 14, for example, recites that an interrogating beam may interact with pump beams "at a substantially transverse angle" instead of "in a substantially parallel manner" as recited in claim 15.

Claims 18, 19, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi (US 4,949,056 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997).

Regarding claim 18, as similarly discussed with regard to claim 1, Akkapeddi discloses a system (Figures 1 and 2) comprising:

a transceiver (satellite 10) constructed to transmit an interrogating beam;

a communication station capable of receiving the interrogating beam; and

the communication station having an phase conjugator 12.

Again, although a communication station is not explicitly labeled in Figure 1, the figure clearly shows elements receiving and processing the beam transmitted from transceiver 10 that may be collectively regarded as a communication station in the art.

Akkapeddi discloses that the phase conjugator 16 is a photorefractive crystal-type phase conjugation element that requires a pump beam from laser 20 (column 2, lines 34-44) but does not specifically disclose that the phase conjugator is a broad area intra-cavity phase conjugator including a top electrode. However, as similarly discussed above with regard to claim 1, Vasil'ev et al. teach a broad area, intra-cavity phase conjugator that does not require an external pump beam source (Figures 1a and 1b; see also page 40, 1st paragraph in the left column and page 42, 1st complete paragraph in the left column) which may be used in a communication system to produce a phase conjugate beam such as in the communication system disclosed by Akkapeddi. The intra-cavity phase conjugator taught by Vasil'ev et al. also includes a top electrode with an aperture (page 40, 2nd complete paragraph in right column, teaches an upper metal contact, or a "top electrode," and also teaches the dimensions of an aperture).

It would have been obvious to use the broad area, intra-cavity phase conjugator taught by Vasil'ev et al. instead of the type of phase conjugator in the system disclosed by Akkapeddi as a way to provide the phase conjugate light beam already disclosed but without requiring a separate source of pump light. One in the art would have been further motivated to incorporate the teachings of Vasil'ev et al. in the system disclosed by Akkapeddi because Vasil'ev et al. specifically teach that broad area, intra-cavity phase conjugators have several additional advantages over photorefractive crystal phase conjugators, including increased speed and portability, and the ability to be more easily integrated into existing systems (page 40, 1st paragraph in the left column).

Regarding claim 19, Akkapeddi discloses that the interrogating beam may interact with at least one pump beam operating in the phase conjugator at a substantially transverse angle (Figure 2).

Regarding claim 21, Vasil'ev et al. do not specifically teach that the aperture is greater than 10 microns, but it would have been obvious to a person of ordinary skill in the art to specify that the aperture in system described by Akkapeddi in view of Vasil'ev et al. be greater than 10 microns as an engineering design choice of a way to allow sufficient light into the phase conjugator by creating a suitably sized opening.

Claims 20 and 48-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi (US 4,949,056 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997) as applied to claim 18 above, and further in view of Watanabe (US 5,920,588 A).

Regarding claims 20, 48, and 49, Akkapeddi in view of Vasil'ev et al. describe a system as discussed above with regard to claim 18.

Regarding claim 48, Vasil'ev et al. teach that the phase conjugator includes a nonlinear medium adapted to produce at least two coherent pump beams (Figure 1b) but do not specifically teach a means to encode the coherent pump beams. Again, Watanabe teaches a means to encode the pump beams (Figure 16, modulating circuit 74). It would also have obvious to a person of ordinary skill in the art to provide a means to encode the pump beams as taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. in order to modulate the beams with information for transmission in the communications system.

Regarding claims 20 and 49, Vasil'ev et al. further teach that the phase conjugator may comprise a broad-area laser device (Abstract) but do not specifically teach a distributed feedback laser device. Again, Watanabe teaches that the nonlinear medium may be a diode structure comprising a distributed feedback laser device. It would have been obvious to use the distributed feedback laser device taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. as an engineering design choice of a nonlinear medium for producing phase conjugation. The claimed differences exist not as a result of an attempt by appellant to solve an unknown problem but merely amount to the selection of expedients known as design choices to one of ordinary skill in the art. Examiner notes appellant has not demonstrated that this particular recited feature (a "distributed feedback laser") is critical; on the contrary, appellant's original specification on page 12-13, for example, discloses that a phase conjugator may comprise a choice of single-stripe devices or a VCSEL structure instead of a "distributed feedback laser" as recited in claims 20 and 49.

Claims 46 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi (US 4,949,056 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997) and Pepper et al. (US 5,038,359 A) as applied to claim 1 above, further in view of Watanabe (US 5,920,588 A).

Regarding claims 46 and 47, Akkapeddi in view of Vasil'ev et al. and Pepper et al. describe a system as discussed above with regard to claim 1. Regarding claim 46, Vasil'ev et al. further teach that the phase conjugator includes a nonlinear medium adapted to produce at least two coherent pump beams (Figure 1b) but do not specifically teach a means to encode the coherent pump beams. Watanabe teaches a means to encode the pump beams (Figure 16,

modulating circuit 74). Regarding claim 47 in particular, Vasil'ev et al. teach that the nonlinear medium is a laser diode structure but not specifically a distributed feedback laser device. However, Watanabe teaches that the nonlinear medium may be a diode structure comprising a distributed feedback laser device. It would have been obvious to use the distributed feedback laser device taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. as an engineering design choice of a nonlinear medium for producing phase conjugation. It would also have obvious to a person of ordinary skill in the art to provide a means to encode the pump beams as taught by Watanabe in the system described by Akkapeddi in view of Vasil'ev et al. and Pepper et al. in order to modulate the beams with information for transmission in the communications system.

Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akkapeddi (US 4,949,056 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997) and Damen et al. (US 5,675,436 A).

Regarding claim 22, Akkapeddi et al. (Figures 1 and 2) disclose a system comprising:

a transceiver constructed to transmit an interrogating beam;

a communication station capable of receiving the interrogating beam; and

the communication station having an phase conjugator.

Akkapeddi et al. do not specifically disclose that the phase conjugator may be a broad area intra-cavity phase conjugator which is a VCSEL structure. However, as similarly discussed above with regard to claim 1, Vasil'ev et al. teach a broad area intra-cavity phase conjugator.

Vasil'ev et al. further teach that the phase conjugator may be a semiconductor laser diode but does not specifically teach that it may by a VCSEL structure. Damen et al. (column 3, lines 37-61) teach that a laser diode that is specifically a VCSEL structure may be used to provide a nonlinear element for four wave mixing such as the laser device taught by Vasil'ev et al. Regarding claim 23 in particular, Vasil'ev et al. further teach that the interrogating beam interacts with at least one pump beam in a substantially parallel manner (Figure 1b).

It would have been obvious to use the broad area, intra-cavity phase conjugator taught by Vasil'ev et al. instead of the type of phase conjugator in the system disclosed by Akkapeddi as a way to provide the phase conjugate light beam already disclosed but without requiring a separate source of pump light. One in the art would have been further motivated to incorporate the teachings of Vasil'ev et al. in the system disclosed by Akkapeddi because Vasil'ev et al. specifically teach that broad area, intra-cavity phase conjugators have several additional advantages over photorefractive crystal phase conjugators, including increased speed and portability, and the ability to be more easily integrated into existing systems (page 40, 1st paragraph in the left column).

Furthermore, it would have been obvious to a person of ordinary skill in the art to specifically use a VCSEL structure as taught by Damen et al. in the system described by Akkapeddi in view of Vasil'ev et al. as an engineering design choice of a way to implement the laser diode device already taught by Vasil'ev et al. The claimed differences exist not as a result of an attempt by appellant to solve an unknown problem but merely amount to the selection of expedients known as design choices to one of ordinary skill in the art. Examiner notes appellant has not demonstrated that this particular recited feature ("a VCSEL structure") is critical; on the

contrary, appellant's original specification on page 12-13, for example, discloses that a phase conjugator may comprise a choice of single-stripe devices or distributed feedback lasers instead of "a VCSEL structure" as recited in claim 22.

Claims 24 and 26-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe (US 5,920,588 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997) and MacDonald (US 5,519,723 A).

Regarding claim 24, Watanabe discloses an optical interconnection system (Figure 2) comprising:

a fiber optic device (fiber 2) constructed to transmit an interrogating beam (ωs) to a predetermined intra-cavity phase conjugator 1.

Although Watanabe discloses transmitting the interrogating beam through a fiber, Watanabe does not specifically disclose a transmitting device which creates the beam. However, it is well known in the art that laser beams such as disclosed by Watanabe may be created by transmitters, and it would have been obvious to a person of ordinary skill in the art to include a transmitter in order to provide the interrogating beam.

Watanabe does not specifically disclose a micro-mirror. However, it is well known in the art that mirrors and other reflectors may be used to steer light beams as desired among elements in an optical system. MacDonald in particular teaches using mirrors M1-M3 to steer light into a nonlinear medium for phase conjugation (Figure 1). It would have been obvious to a person of ordinary skill in the art to use a mirror as taught by MacDonald in the system disclosed by Watanabe in order to steer the interrogating beam in whatever direction required by the

placement of elements in the system. It would be well understood in the art that the light from the fiber 2 in the system disclosed by Watanabe in Figure 1, for example, must be properly aligned with the laser diode phase conjugator device 1 in order to produce the output beams as disclosed.

Watanabe discloses an intra-cavity laser diode phase conjugator element (i.e., element 1 in Figure 2) but does not specifically disclose that the phase conjugator specifically may be a broad area phase conjugator. However, Vasil'ev et al. teach a intra-cavity phase conjugator that is also a laser diode element (like the phase conjugator element already disclosed by Watanabe) and further teach that it may be a broad area device (page 40, 1st complete paragraph in right column). It would have been obvious to a person of ordinary skill in the art to use the broad area phase conjugator taught by Vasil'ev et al. as the phase conjugator in the system suggested by Watanabe in view of MacDonald as an engineering design choice of a way to implement the intra-cavity laser diode phase conjugator already disclosed by Watanabe.

Regarding claim 26, Watanabe discloses that the interrogating beam may interact with at least one pump beam operating in the phase conjugator in a substantially parallel manner (Figure 2).

Regarding claims 27 and 33, Watanabe further discloses that the phase conjugator may include a top electrode with an aperture (Figure 2), and the phase conjugator taught by Vasil'ev et al. also includes a top electrode and an aperture (column 2) .

Regarding claim 28, Watanabe discloses that the phase conjugator may comprise a distributed feedback laser device (Figure 2; column 16, column 23-67; column 17, lines 1-3).

Regarding claim 29, Watanabe does not specifically disclose that the interrogating beam interacts with the at least one pump beam at a transverse angle. However, MacDonald teaches that an interrogating beam may interact with a pump beam in a phase conjugator such as disclosed by Watanabe at a transverse angle instead. It would have been obvious to a person of ordinary skill in the art to use an angle such as taught by MacDonald in the system described by Watanabe in view of MacDonald in order to accommodate the position of the elements in relation to each other.

Regarding claim 30, Watanabe discloses that the predetermined phase conjugator may be one of a plurality of phase conjugators arranged in an array (Figure 21). Regarding claim 31, Watanabe does not specifically disclose that this array may be a first array of a plurality of arrays, but it would have been obvious to a person of ordinary skill in the art to include a plurality of arrays of phase conjugators in the system disclosed by Watanabe as an engineering design choice of a way to arrange the phase conjugators to accommodate however many separate signals needed in the system.

Regarding claim 32, Watanabe discloses that the phase conjugator may comprise a single gain stripe device (column 16, lines 43-67; column 17, lines 1-3).

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe (US 5,920,588 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997) and MacDonald (US 5,519,723 A) as applied to claim 24 above and further in view of Damen et al. (US 5,675,436 A).

Regarding claim 25, Watanabe in view of Vasil'ev et al. and MacDonald suggest a system including a phase conjugator comprising a broad-area, distributed feedback laser device

as discussed above with regard to claim 24, but they do not specifically teach that it may by a VCSEL structure. Damen et al. (column 3, lines 37-61) teach that a VCSEL structure may be used to provide a nonlinear element for four wave mixing such as the laser device taught by Watanabe in view of Vasil'ev et al. and MacDonald. It would have been obvious to use a phase conjugator which is a VCSEL structure as taught by Damen et al. in the system disclosed by Watanabe in view of Vasil'ev et al. and MacDonald as an engineering design choice of a phase conjugating medium. The claimed differences exist not as a result of an attempt by appellant to solve an unknown problem but merely amount to the selection of expedients known as design choices to one of ordinary skill in the art. Examiner notes appellant has not demonstrated that this particular recited feature ("a VCSEL structure") is critical; on the contrary, appellant's original specification on page 12-13, for example, discloses that a phase conjugator may comprise a choice of single-stripe devices or distributed feedback lasers instead of "a VCSEL structure" as recited in claim 25.

Claims 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharp et al. (US 5,317,442 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997).

Regarding claim 34, Sharp et al. disclose a system (Figures 2 and 5) comprising:

a means (remote laser beacon 23) for transmitting and receiving an interrogating beam;

a communication station 50 operatively coupled to the transmitting and receiving means

wherein the station includes a means (crystal 20) for returning a phase conjugate beam to the transmitting and receiving means (column 2, lines 26-42).

Sharp et al. disclose that the phase conjugator 20 is a photorefractive crystal-type phase conjugation element that requires a pump beam from laser 21 and do not specifically disclose a broad area intra-cavity phase conjugator. However, Vasil'ev et al. teach a broad area, intra-cavity phase conjugator that does not require an external pump beam source (Figures 1a and 1b; see also page 40, 1st paragraph in the left column and page 42, 1st complete paragraph in the left column) which may be used in a communication system to produce a phase conjugate beam such as in the communication system disclosed by Sharp et al.

It would have been obvious to use the broad area, intra-cavity phase conjugator taught by Vasil'ev et al. instead of the type of phase conjugator in the system disclosed by Sharp et al. as a way to provide the phase conjugate light beam already disclosed but without requiring a separate source of pump light. One in the art would have been further motivated to incorporate the teachings of Vasil'ev et al. in the system disclosed by Sharp et al. because Vasil'ev et al. specifically teach that broad area, intra-cavity phase conjugators have several additional advantages over photorefractive crystal phase conjugators, including increased speed and portability, and the ability to be more easily integrated into existing systems (page 40, 1st paragraph in the left column).

Regarding claim 35, Sharp et al. disclose a method (Figures 2 and 5) comprising:

transmitting an interrogating beam from a transceiver 52;

receiving the interrogating beam at a communication station 50;

encoding data (with modulator 29) onto a phase conjugate beam; and

transmitting the encoded phase conjugate beam back to the transceiver (column 2, lines 26-42).

Sharp et al. do not specifically disclose producing the phase conjugate beam with a broad area intra-cavity phase conjugator or pumping the encoded phase conjugate reflectivity by nondegenerate four wave mixing. However, as already discussed above with regard to claim 34, Vasil'ev et al. teach a broad area intra-cavity phase conjugator and teach that four wave mixing is a known way of producing phase conjugate beams such as disclosed by Sharp et al. (Abstract). Again, it would have been obvious to use the broad area, intra-cavity phase conjugator taught by Vasil'ev et al. instead of the type of phase conjugator in the system disclosed by Sharp et al. as a way to provide the phase conjugate light beam already disclosed but without requiring a separate source of pump light. One in the art would have been further motivated to incorporate the teachings of Vasil'ev et al. in the system disclosed by Sharp et al. because Vasil'ev et al. specifically teach that broad area, intra-cavity phase conjugators have several additional advantages over photorefractive crystal phase conjugators, including increased speed and portability, and the ability to be more easily integrated into existing systems (page 40, 1st paragraph in the left column).

Claims 36-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharp et al. (US 5,317,442 A) in view of Pepper et al. (US 5,038,359 A) and Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997).

Regarding claim 36, Sharp et al. disclose a method (Figures 2 and 5) comprising:

transmitting an interrogating beam from a transceiver 52;

receiving the interrogating beam at a phase conjugator 20;

modulating data onto a phase conjugate beam (with modulator 29); and

transmitting the phase conjugate beam to the transceiver (as beam 26 shown in Figures 2 and 5).

Sharp et al. does not specifically disclose an array of phase conjugators. However, Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) also teach phase conjugator elements (i.e., elements 174, 176, and 178 in Figure 10) and also further suggests that phase conjugators may be arranged in an array. It would have been obvious to a person of ordinary skill in the art to further arrange the phase conjugators in an array as taught by Pepper et al. in the system disclosed by Sharp et al.. to provide a broader area for producing phase conjugation. In other words, one in the art would have been particularly motivated to incorporate the teachings of Pepper et al. in the system disclosed by Sharp et al. so that more than one beam may be received by the phase conjugator system at more than one specific location (especially in a large aperture system as specifically suggested by Pepper et al.; column 10, lines 60-62 and column 11, lines 11-13).

Again, Sharp et al. also do not specifically disclose producing the phase conjugate beam with a broad area intracavity phase conjugator, but Vasil'ev et al. teach a broad area, intra-cavity phase conjugator that does not require an external pump beam source (Figures 1a and 1b; see also page 40, 1st paragraph in the left column and page 42, 1st complete paragraph in the left column) which may be used in a communication system to produce a phase conjugate beam such as in the communication system disclosed by Sharp et al.

It would have been obvious to use the broad area, intra-cavity phase conjugator taught by Vasil'ev et al. instead of the type of phase conjugator in the system disclosed by Sharp et al. as a way to provide the phase conjugate light beam already disclosed but without requiring a separate

source of pump light. One in the art would have been further motivated to incorporate the teachings of Vasil'ev et al. in the system disclosed by Sharp et al. because Vasil'ev et al. specifically teach that broad area, intra-cavity phase conjugators have several additional advantages over photorefractive crystal phase conjugators, including increased speed and portability, and the ability to be more easily integrated into existing systems (page 40, 1st paragraph in the left column).

Regarding claim 37, Sharp et al. disclose that their method may further comprise collecting data through a sensor 24 located in proximity to the phase conjugator and transmitting the data to the phase conjugator (using modulator 29).

Regarding claim 38, Sharp does not specifically disclose that the interrogating beam interacts with at least one pump beam operating in each of the phase conjugators in a substantially parallel manner. However, Pepper et al. teach that the interrogating beam may interact with pump beams operating in the plurality of phase conjugators in a substantially parallel manner (Figure 8). It would have been obvious to a person of ordinary skill in the art to arrange the interrogating beam and pump beams as suggested by Pepper et al. in the method described by Sharp et al. in view of Pepper et al. and Vasil'evet al. as an engineering design choice of the most convenient angle for the arrangement of elements. Examiner notes appellant has not demonstrated that this particular recited feature ("a substantially parallel manner") is critical; on the contrary, appellant's claim 39, for example, recites that an interrogating beam may interact with pump beams "at a substantially transverse angle" instead of "in a substantially parallel manner" as recited in claim 38.

Regarding claim 39, Sharp et al. discloses that the interrogating beam interacts with at least one pump beam operating in the phase conjugator in a substantially transverse manner (Figure 2).

Claims 42-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pepper et al. (US 5,038,359 A) in view of Vasil'ev et al. ("Phase-conjugation broad area twin-contact semiconductor laser," Applied Physics Letters, July 1997).

Regarding claim 42, Pepper et al. disclose a method of providing an optical interconnect (Figure 1, for example) comprising:

transmitting an interrogating beam from a fiber optic device (laser 20);

receiving the interrogating beam at a micro-mirror (reflector array 16; column 7, lines 11-22) across free space;

transmitting a second beam from the micro-mirror (i.e., a second beam is reflected from element 16); and

producing a phase conjugate beam 24 of the second beam received from the micro-mirror by a predetermined phase conjugator 12 (column 5, lines 24-61).

Figures 4 and 5 also show similarly numbered elements arranged in slightly different embodiments but still disclosing the method steps as discussed above with regard to Figure 1.

With regard to a "fiber optic device," Pepper et al. specifically disclose that the system they disclose may be used in fiber optic applications (column 5, lines 19-23). It is also well known in the art that the laser element 20 such as they disclose may be suitable for use in a fiber optic system. The claim does not specifically recite optical fiber.

Pepper et al. do not specifically disclose a broad area intra-cavity phase conjugator, but Vasil'ev et al. teach a phase conjugation system including a broad area intra-cavity phase conjugator device(the laser diode element in Figure 1b) and, as in the system disclosed by Pepper et al., an external reflector element (the tilted mirror in Figure 1b) . It would have been obvious to a person of ordinary skill in the art to use the phase conjugator taught by Vasil'ev et al. as the phase conjugator in the system disclosed by Pepper et al. as an engineering design choice of a phase conjugating means which does not require a separate source of pump light. Additionally, Vasil'ev et al. teach that their broad area intra-cavity phase conjugator device is less sensitive to misalignments of the external reflector, and it would have been obvious to a person of ordinary skill in the art touse the broad area intra-cavity phase conjugator device taught by Vasil'ev et al. in the method disclosed by Pepper et al. in order to reduce the need to precisely align the micro-mirror in the system.

Regarding claim 43, Pepper et al. disclose that the method may further include modulating data onto the second beam at said predetermined phase conjugator (with frequency shifter 62 and/or modulator 64 shown in Figure 4, as well as Figures 6-10; column 8, lines 32-50);

transmitting an encoded phase conjugated beam to the micro-mirror 16.

Regarding claim 44, Pepper et al. disclose that the method may further include transmitting a third beam from the micro-mirror to the fiber optic device. Figure 7, for example, shows how several beams travels from the mirror 16 through lens 106 back toward the fiber optic device(the fiber optic device, shown as a laser 20 in Figure 6, is not explicitly shown in Figure 7 but is discussed by Pepper et al. as part of the system; column 9, lines 56-61).

(11) Response to Argument

Regarding claims 1-7, 9-14, 16, 17, 40, 41, and 45 in particular, and in response to appellant's argument in the brief (section "A1" on pages 11-12 in particular) that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

In this case, Examiner respectfully disagrees with appellant's assertion in the brief that there is no motivation to combine Akkapeddi and Vasil'ev et al. Akkapeddi already discloses a phase conjugator (element 16), but it is a photorefractive crystal-type phase conjugation element that requires a pump beam from laser 20 (column 2, lines 34-44). Vasil'ev et al. teach a broad area, intra-cavity device that also provides phase conjugation as already disclosed by Akkapeddi but that does not require an external pump beam source (Figures 1a and 1b; see also page 40, 1st paragraph in the left column and page 42, 1st complete paragraph in the left column). It would have been obvious to use the broad area, intra-cavity phase conjugator taught by Vasil'ev et al. instead of the type of phase conjugator in the system disclosed by Akkapeddi as a way to provide the phase conjugate light beam already disclosed but without requiring a separate source of pump light. Vasil'ev et al. further specifically teach that such broad area, intra-cavity phase conjugators have several additional advantages over photorefractive crystal phase conjugators, including increased speed and portability, and the ability to be more easily integrated into existing systems

(page 40, 1st paragraph in the left column). Therefore, one in the art would have been motivated to combine the teachings of Vasil'ev et al. in the system disclosed by Akkapeddi in order to achieve the above advantages.

Furthermore, where the claimed differences involve the substitution of interchangeable or replaceable equivalents and the reason for the selection of one equivalent for another was not to solve an existent problem, such substitution has been judicially determined to have been obvious. In re Reff, 118, USPQ 343 (CCPA1958). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to replace the type of phase conjugator disclosed by Akkapeddi with the well known type phase conjugator taught Vasil'ev et al. in order not only to gain the advantages discussed above but to allow self-aligned and self-pumped spatially nondegenerate four-wave mixing to be achieved without the need for external optical signals and to exhibit very good mechanical stability (see abstract of Vasil'ev et al). This supporting rationale is based on a recognition that the claimed differences exist not as a result of an attempt by appellant to solve a problem but merely amount to selection of expedients known to the artisan of ordinary skill as design choices.

Examiner further respectfully disagrees with appellant's assertion in the brief that there is no motivation to combine Akkapeddi, Vasil'ev et al., and Pepper et al. Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) also teach a related phase conjugation system with phase conjugator elements (i.e., elements 174, 176, and 178 in Figure 10) and also further suggests that phase conjugators may be arranged in an array. It would have been obvious to a person of ordinary skill in the art to further arrange the phase conjugators in an array as taught by Pepper et al. in the system suggested by Akkapeddi in view of Vasil'ev et al. to provide a

broader area for producing phase conjugation and so that more than one beam may be received by the phase conjugator system at more than one specific location (especially in a large aperture system as specifically suggested by Pepper et al.; column 10, lines 60-62 and column 11, lines 11-13).

Examiner notes that claims 1, 2, 6, 7, 9, 12, 13, 16, 17, and 45 do not recite any specific interaction or connection between the recited interrogating beam and the recited phase conjugator elements.

Further regarding claims 1-7, 9-14, 16, 17, 40, 41, and 45 in particular, and in response to appellant's argument in the brief (sections "A2" and "A3" on pages 12-13 in particular) that Vasil'ev et al. teach away from the claimed invention and the references are not properly combinable because their intended function is destroyed, Vasil'ev et al. state that "SLDs are not truly suitable for turbulence aberration correction as opposed to Na vapour or photorefractive crystals" (page 42, end of 1st complete paragraph in right column), but Examiner respectfully notes that Vasil'ev et al. do not completely rule out using SLDs in an atmospheric correction system. A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use. In re Gurley, 27 F. 3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994). In this case, Vasil'ev et al. suggests that an SLD may not be "truly suitable" in an aberration correction system, at least in comparison to Na vapour and photorefractive crystals as an example, but they also suggest that this application of an SLD is known in the art, although it may be inferior. Furthermore, Vasil'ev et al on page 40, 1st paragraph in left column, clearly teach that laser diodes are suitable for use in many communications systems. Consequently, Vasil'ev et al. not only teach the benefits of broad area,

intra-cavity devices but also indicate that such devices can be used with many communication systems.

Examiner also respectfully notes that some features upon which appellant relies (i.e., "two-dimensional spatial phase conjugation for communicating through the atmosphere," or atmospheric aberration correction in general) are not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Regarding claims 8 and 15 in particular, Examiner respectfully disagrees with appellant's reiteration of the argument in the brief (section "B" on pages 15 and 16 in particular) that Akkapeddi and Vasil'ev et al. are not combinable, for the same reasons Examiner has given above with particular regard to claims 1-7, 9-14, 16, 17, 40, 41, and 45. Further regarding claims 8 and 15, in response to appellant's argument that the secondary references in the 35 U.S.C. 103(a) rejection (Vasil'ev et al., Pepper et al., and Watanabe) do not teach correcting for atmospheric distortions, Examiner again respectfully notes that Vasil'ev et al. do not completely rule out using SLDs in an atmospheric correction system. A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use. In re Gurley, 27 F. 3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994). Examiner also again respectfully notes that atmospheric aberration correction is not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Regarding claims 18-23 and 46-49 in particular, Examiner respectfully disagrees with appellant's reiteration of the argument in the brief (sections "C," "D," and "E" on pages 16-17 in particular) that Akkapeddi and Vasil'ev et al. are not combinable, for the same reasons Examiner has given above with particular regard to claims 1-7, 9-14, 16, 17, 40, 41, and 45.

Regarding claims 24 and 26-33 in particular, Examiner respectfully disagrees with appellant's argument in the brief (sections "F" and "G" on page 17 in particular) that "no suggestion or motivation is present [in the references]...either individually or combined to show an obvious combination of claim elements." Examiner respectfully notes that MacDonald was relied upon in the rejection of claim 24 in particular because MacDonald teaches that mirrors may be used to direct light from a light source (laser 12 in Figure 1, for example) to other elements in a system, including a nonlinear medium for phase conjugation (element 14 in Figure 1). MacDonald provides a specific teaching of using a mirror to direct light, but Examiner also notes that it is well known in the art that mirrors may be generally used for such purposes. Examiner further notes that it is well known in the art that for practical reasons such as the design of existing elements in a system, various elements in a system may not be ideally aligned to properly transmit light between them and would therefore require some means such as a mirror to adjust and redirect the light. Regarding the system disclosed by Watanabe in particular, it would be well understood in the art that the light from the fiber 2 must be properly aligned with the laser diode phase conjugator device 1 in order to produce the output beams as disclosed.

In response to appellant's argument that the mirror taught by MacDonald is used by MacDonald in a "confocal resonator" system different from the system disclosed by Watanabe, Examiner notes that MacDonald is relied upon only to provide a teaching that mirrors may direct

light between elements in an optical system including light sources and phase conjugation elements such as shown by both Watanabe and MacDonald. The combination of Watanabe and MacDonald does not necessarily yield a system including all of the elements of both systems.

The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Regarding claims 34-39 in particular, and in response to appellant's argument in the brief (sections "H" and "I" on pages 20-21 in particular) that "there is not teaching or suggesting in either Sharp et al. or Vasil'ev et al. of making such a combination," Examiner respectfully notes that Sharp et al. already disclose a phase conjugator (crystal 20), but it is a photorefractive crystal-type phase conjugation element that requires a pump beam from laser 21 (column 3, lines 50-54). Vasil'ev et al. teach a broad area, intra-cavity device that also provides phase conjugation as already disclosed by Sharp et al. but that does not require an external pump beam source (Figures 1a and 1b; see also page 40, 1st paragraph in the left column and page 42, 1st complete paragraph in the left column). It would have been obvious to use the broad area, intra-cavity phase conjugator taught by Vasil'ev et al. instead of the type of phase conjugator in the system disclosed by Sharp et al. as a way to provide the phase conjugate light beam already disclosed but without requiring a separate source of pump light. Vasil'ev et al. further specifically teach that such broad area, intra-cavity phase conjugators have several additional advantages over photorefractive crystal phase conjugators, including increased speed and

portability, and the ability to be more easily integrated into existing systems (page 40, 1st paragraph in the left column). Therefore, one in the art would have been motivated to combine the teachings of Vasil'ev et al. in the system disclosed by Sharp et al. in order to achieve the above advantages.

Examiner also notes that claim 34 does not recite any specific interaction or connection between the recited interrogating beam and the recited phase conjugator elements.

Regarding claims 42-44 in particular, Examiner respectfully disagrees with appellant's argument in the brief (section "J" on pages 22 and 23 in particular) that "Pepper et al. does not show a single step having the respective claim limitations as shown in claim 42 above" (page 23 of the brief). As already discussed in greater detail above in the Grounds of Rejection, Pepper et al. disclose a method of providing an optical interconnect (Figures 1, 4, and 5, for example) comprising:

transmitting an interrogating beam from a fiber optic device (laser 20);

receiving the interrogating beam at a micro-mirror (reflector array 16; column 7, lines 11-22) across free space;

transmitting a second beam from the micro-mirror (i.e., a second beam is reflected from element 16); and

producing a phase conjugate beam 24 of the second beam received from the micro-mirror by a predetermined phase conjugator 12 (column 5, lines 24-61).

Examiner respectfully notes that the first three steps disclosed by Pepper et al. and outlined above (i.e., transmitting an interrogating beam; receiving it; and transmitting a second beam) have the respective claim limitations as shown in Appellant's claim 42, while the fourth

step disclosed by Pepper et al. is also similar to a recited step in Appellant's claim 42 (but lacking a specifically broad area intra-cavity-type phase conjugator element, which is taught by Vasil'ev et al., as discussed in the Grounds of Rejection).

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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